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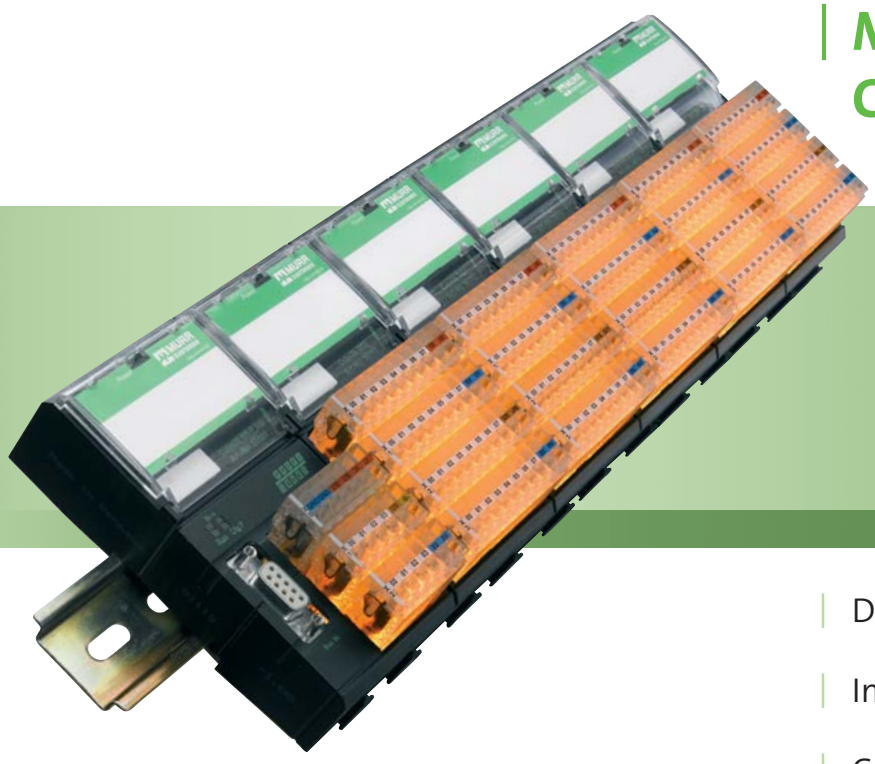

Manual
Cube20 System

- Description
- Installation
- Configuration Notes
- Diagnostics

Publisher's Note

Instruction manual for devices from the Cube20 product line

General System Manual

Version 1.3

Edition 07_11 EN

Article number 56030

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About the User Manual and its Structure

Bus Manual:
General explanations and functions for each bus.

On this subject, please click on the links to the next page.

System Manuals:
Describe the system in general and give an overview about the products, accessories and documentation.

Art. No.	Designation
56030	Cube 20 System
56970	Cube 67 System
56974	Cube 67+ System

www.murrelektronik.com

Product Manuals:
Describe product-specific features.

Art. No.	Designation
56001	Cube20 BN-P DI8
56005	Cube20 BN-E DI8
56006	Cube20 BN-PNIO DI8
56035	Cube20 Erweiterungen

www.murrelektronik.com

Here are links to the bus unser manuals:

>>> PROFIBUS (www.profibus.com)

>>> PROFINET (www.PROFINET.com)

>>> ODVA (www.odva.org)

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Important Information

Necessary basic knowledge

This manual contains general system information. For more detailed information please refer to the corresponding bus manuals and to the product manuals.

Understanding this manual requires general knowledge in automation technology.

Symbols and Icons

This manual contains information and instructions you must comply with in order to maintain safety and avoid personal injury or damage to property. They are identified as follows:

Notes indicate important information.

Warnings contain information that, if you ignore this information, may cause damage to equipment or other assets or, if you fail to comply with safety precautions, may constitute a danger to the user's health and life.

These instructions are recommendations issued by Murrelektronik.

Intended Purpose

Read this manual carefully before startup of the equipment. Keep it in a location that is accessible to all users at all times.

The products that are described in this manual were developed, manufactured, tested, and documented in compliance with the relevant safety standards. In normal cases, these products do not constitute any danger to persons or objects, provided the handling specifications and safety instructions described in this manual are observed. They meet the following requirements:

- EMC directive (2004/108/EEC)

The products are designed for industrial use. An industrial environment is defined as one in which loads are not connected directly to the public low-voltage power grid. Additional measures must be taken if the products are used in private, business, or trade environments.

The safe, troublefree functioning of the products requires proper transportation, storage, mounting, and installation, and careful operation. Operation of the devices for their intended purposes is only guaranteed when the enclosures are fully mounted. If aggressive media are used, check their material resistance depending on the application.

Current safety and accident prevention laws valid for a specific application must be observed for the configuration, installation, setup, maintenance, and testing of the devices. The power supply must correspond to SELV or PELV standards. Power sources in accordance with EN 61558-2-6 (transformer) or EN 60950-1 (switched-mode power supply) meet these requirements.

Only use cables that meet the requirements and regulations for safety, electromagnetic compatibility, and, if necessary, telecommunications terminal equipment specifications.

Information on the cables and accessories that are suitable for use with this product are contained in the section "System Components" of this manual.

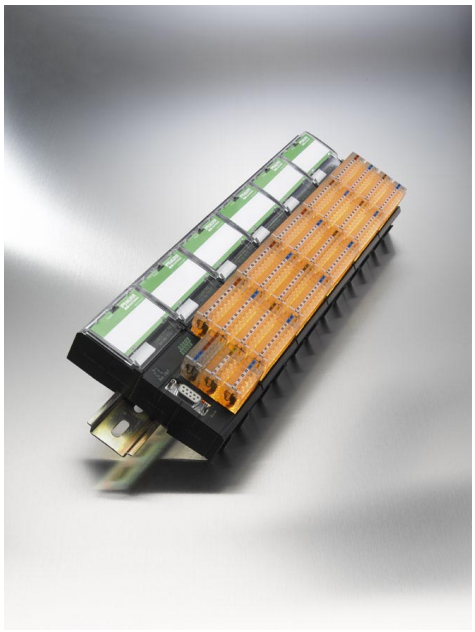
Qualified Personnel

Only qualified, trained electricians knowledgeable in the safety standards of automation systems may configure, install, set up, maintain, and test the devices. The requirements concerning qualified personnel are dependent on the requirements profiles described in ZVEI and VDMA. For this reason, electricians must know the contents of the manual "Weiterbildung in der Automatisierung" (Further Training in Automation Systems) published by ZVEI and VDMA published by Maschinenbau-Verlag, Post Box 710864, 60498 Frankfurt, Germany) before installing and maintaining the devices. These are specialists who are capable of assessing the work to be done and the possible dangers on account of their technical training, knowledge, experience, and knowledge of the relevant standards; or who have an identical level of knowledge equivalent to technical training since they have worked in the same area for many years.

Only Murrelektronik technical personnel are allowed to execute work on the hardware and software of our devices, if they are devices not described in this manual.

Unqualified tampering with the hardware or software, or failure to observe the warnings cited in this manual may result in severe personal injury or damage to property.

1. Description of the Cube20 System



Murrelektronik Cube20 is a fieldbus I/O station with modular expandability. It is strictly oriented by the requirements of modern wiring in control cabinets. Due to its compact design Cube20 provides a very high channel density in a small space. This allows up to 488 I/Os on just 90 centimeters of DIN rail.

All Cube20 modules are equipped with coded plug terminals for typical control cabinet 1-wire connectivity. Murrelektronik's experience in electrical engineering shows that many control cabinets have up to 100 I/O points or more. Compared to the complex structure of I/O stations consisting of numerous individual components, Cube20 offers the advantage of lower installation costs and smaller profiles and its modular design does not leave many terminals unused. Moreover, using Cube20 has an impact on inventory and purchasing. It helps to significantly reduce the hidden costs caused by handling various individual components.

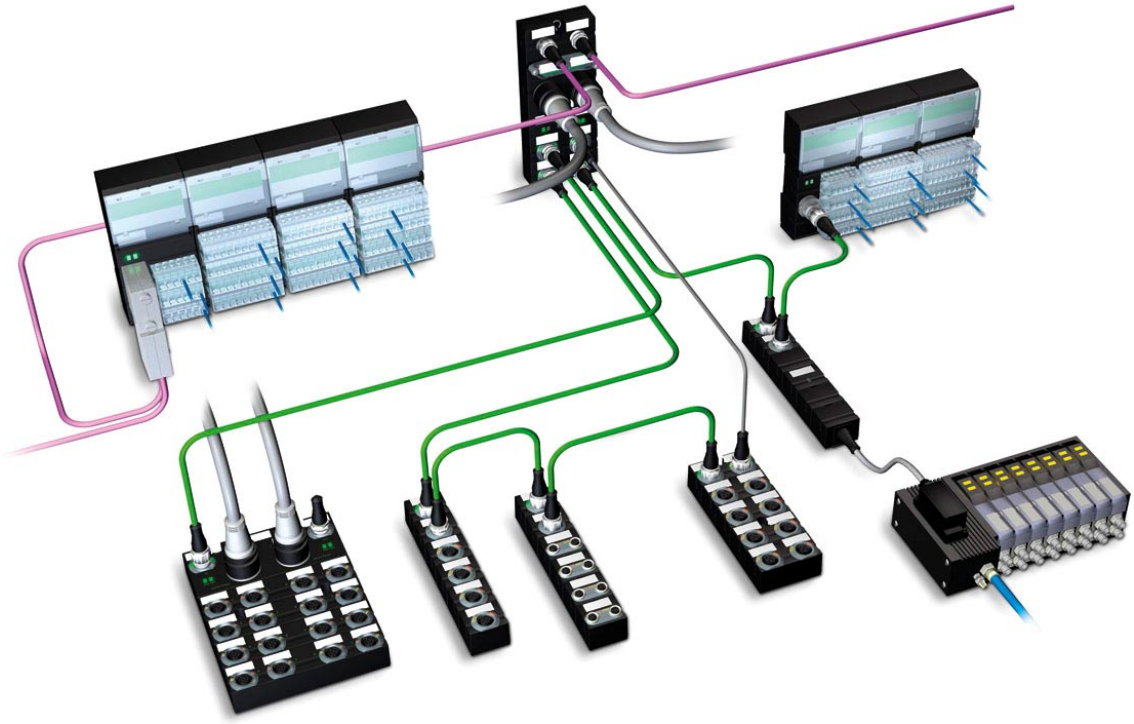
Thanks to the expandability of Cube20, customers can choose from a variety of many digital and analog input and output models with universal applications. There are different bus nodes available for the connection to a higher-level system, therefore it is possible to exchange buses without changing the system. This is a great advantage for the designer: Customer-specific requirements can be realized in a simple and time-saving way. Cube20 can be operated as stand-alone unit at the fieldbus, and also in combination with Cube67. This allows an even more economic use of existing resources such as Cube67 bus nodes.

It is possible to operate Cube67 modules on a Cube20 bus node by using a Cube20/67 interface module.

Cube20 I/O modules are galvanically separated and have an integrated supply terminal. This simplifies the implementation of different potential groups.

All Cube20 modules are equipped with a continuous, convenient diagnostic system as standard. LEDs light up precisely where the problem is; in addition a message is generated and sent to the control. This simplifies the first startup and allows pinpoint localization of sources of interference. This helps to significantly reduce downtime, increase productivity, and troubleshoot faulty components.

1.1 Picture of a Cube20 System Application



1.2 Explanation of the bus systems

For the descriptions of the different bus types please refer to the bus manuals.

You will find an overview in the section "Manual Overview and Layout" in this manual.

1.3 The Cube20 System in the Bus Network

The Cube20 system is a modular I/O system with IP20 protection for decentralized collection and control of digital and analog process variables. It consists of a fieldbus specific bus node and I/O modules that are independent of the fieldbus and are connected to the bus node via an internal system connection.

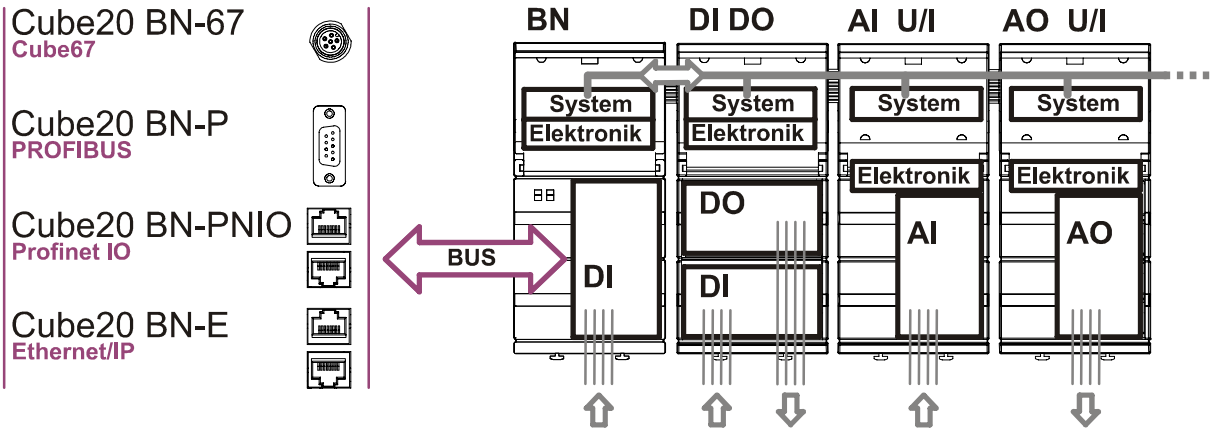


Fig. 1: Typical System Design

1.4 The Cube20/67 Interface Module

The Cube20/67 interface module links the Cube20 System to the Cube67 System. The interface module is a passive module. It supplies no fieldbus diagnostic. A diagnostic is only possible using an LED display.

It is possible to connect Cube67 modules to a Cube20 bus node by using a Cube20/67 interface module. Up to 15 Cube67 modules are connectable. However, the number of Cube20 and Cube67 modules may not exceed 15 modules. It is possible to connect the Cube20 BN67 DIO8 module, Art. No. 56450.

The max. length of the Cube67 system cable is 10 m.

The 0 V potential of the interface module must be tied to the bus node GND potential.

2. Installation

2.1 Mounting

2.1.1 Dimensioning

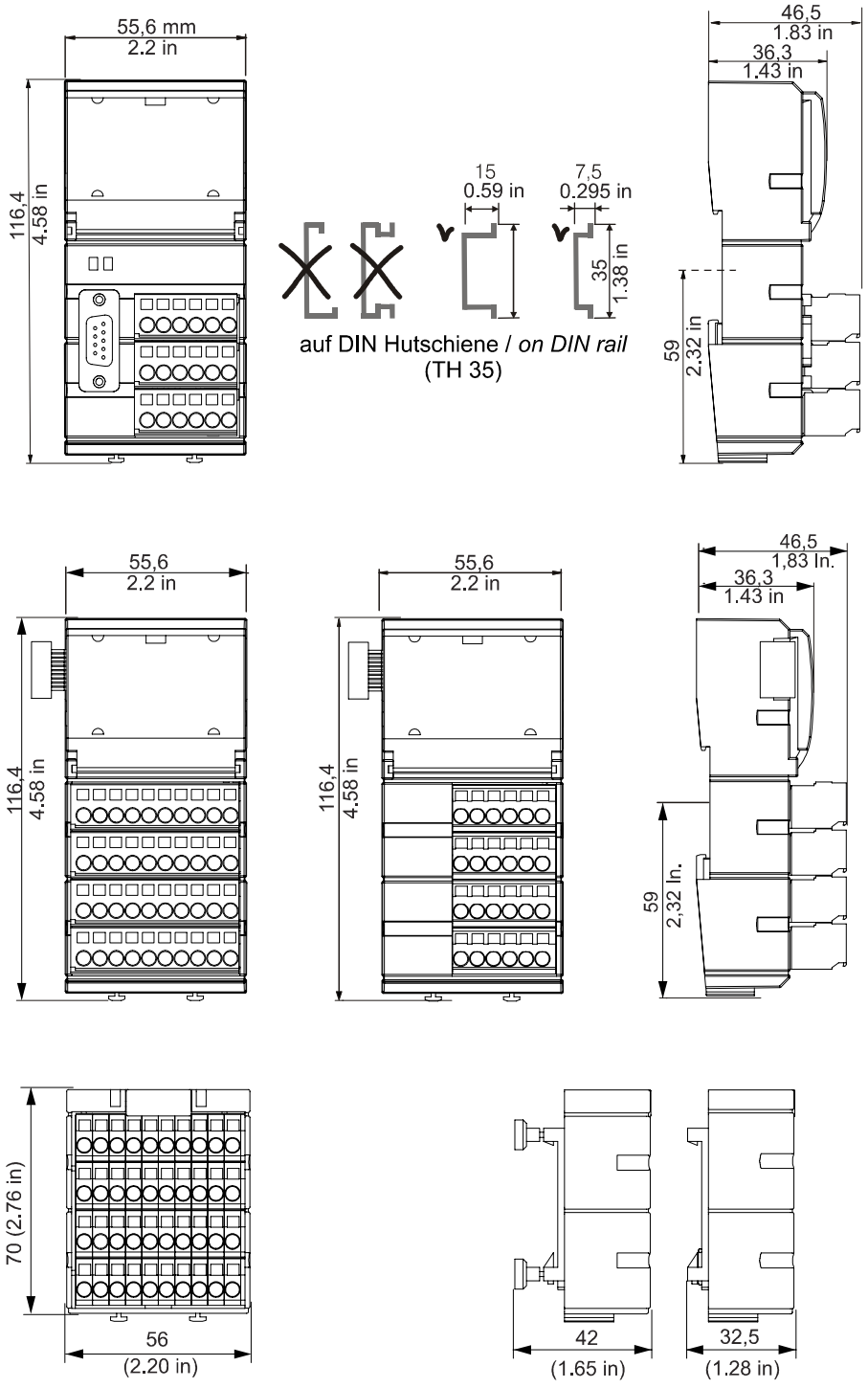


Fig. 2: Dimensioning

2.1.2 Spacing

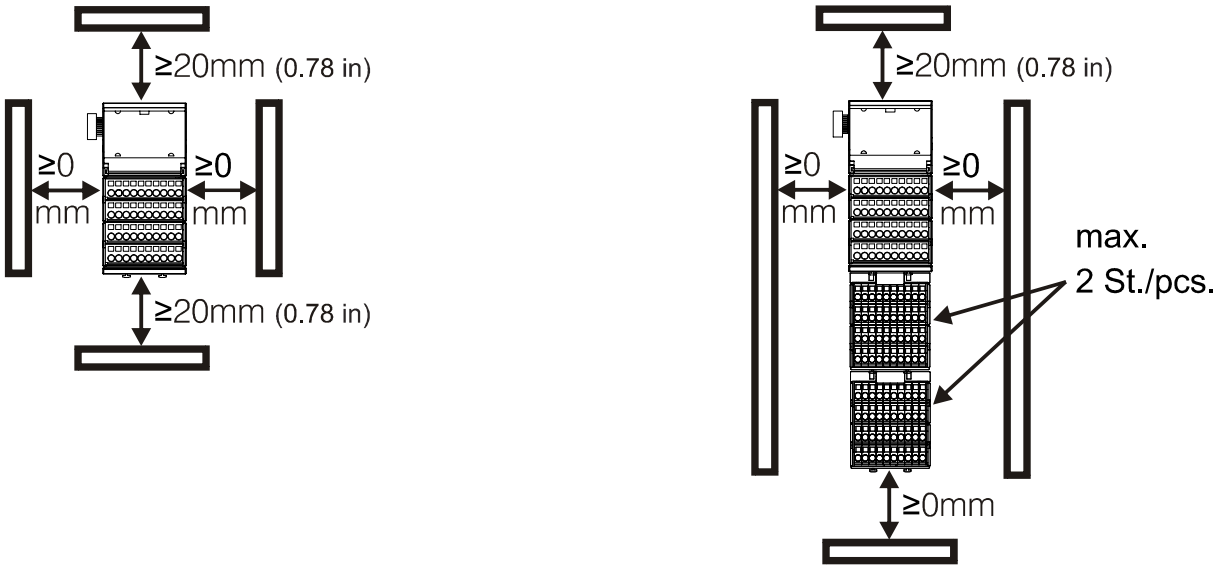


Fig. 3: Spacing

2.1.3 Mounting position

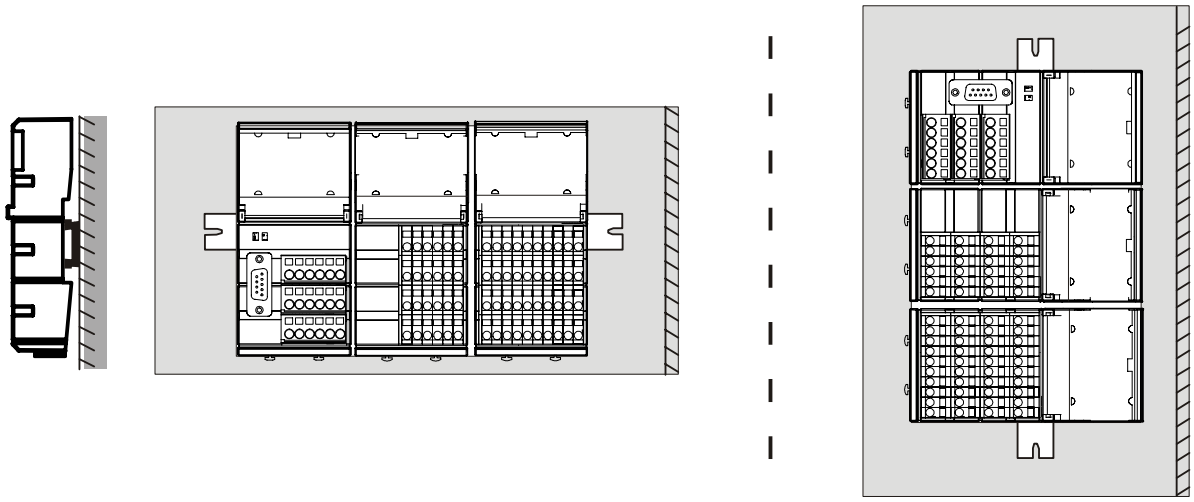


Fig. 4: Mounting position

The potential terminal boxes can be mounted in any position.

2.1.4 Mounting Cube20 Modules on DIN rail and mounting the terminals

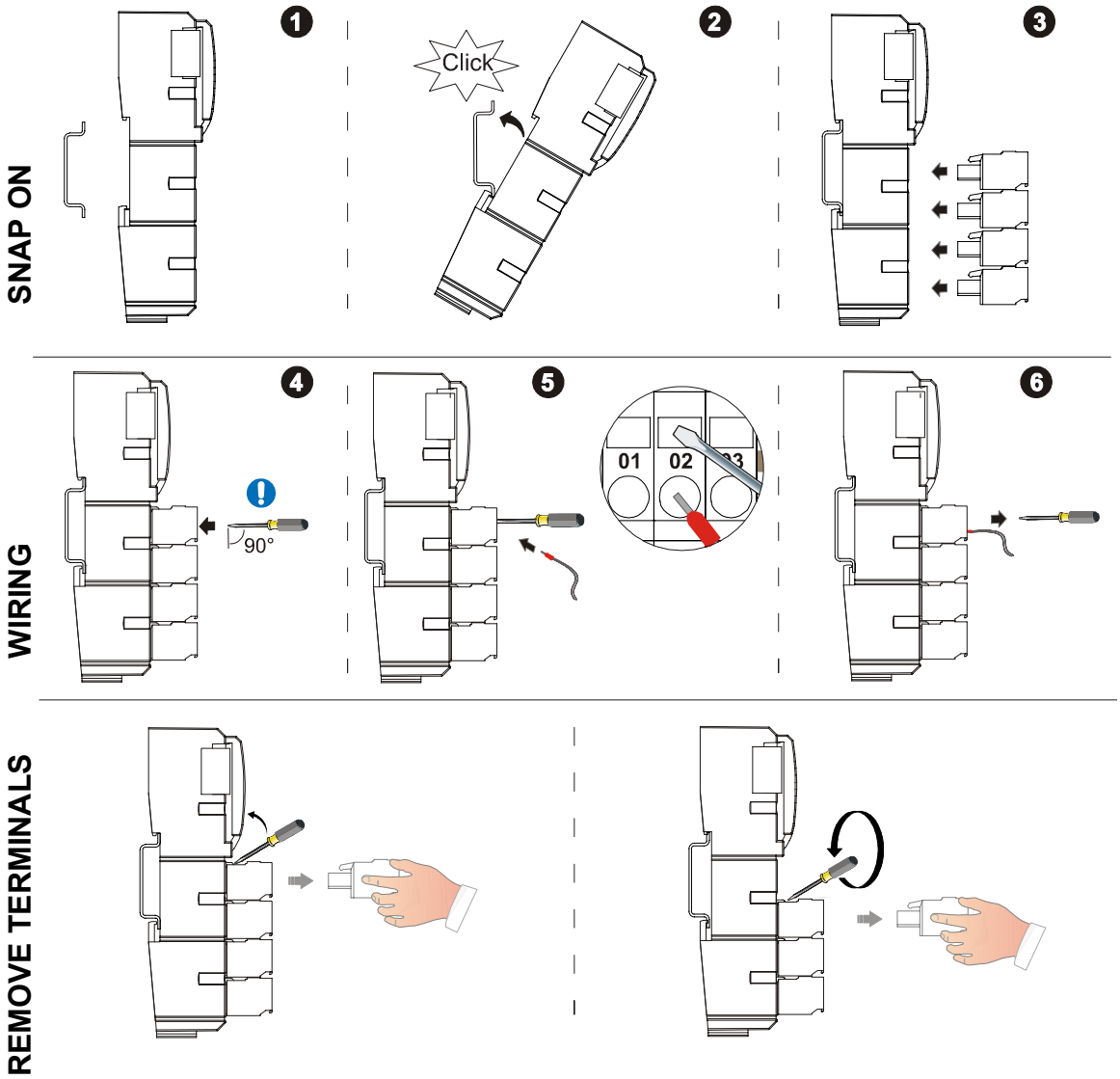


Fig. 5: Mounting Cube20 Modules on DIN rail and mounting the terminals

2.1.5 Mounting the Potential Terminal Block on DIN rail and on the Cube20 Module

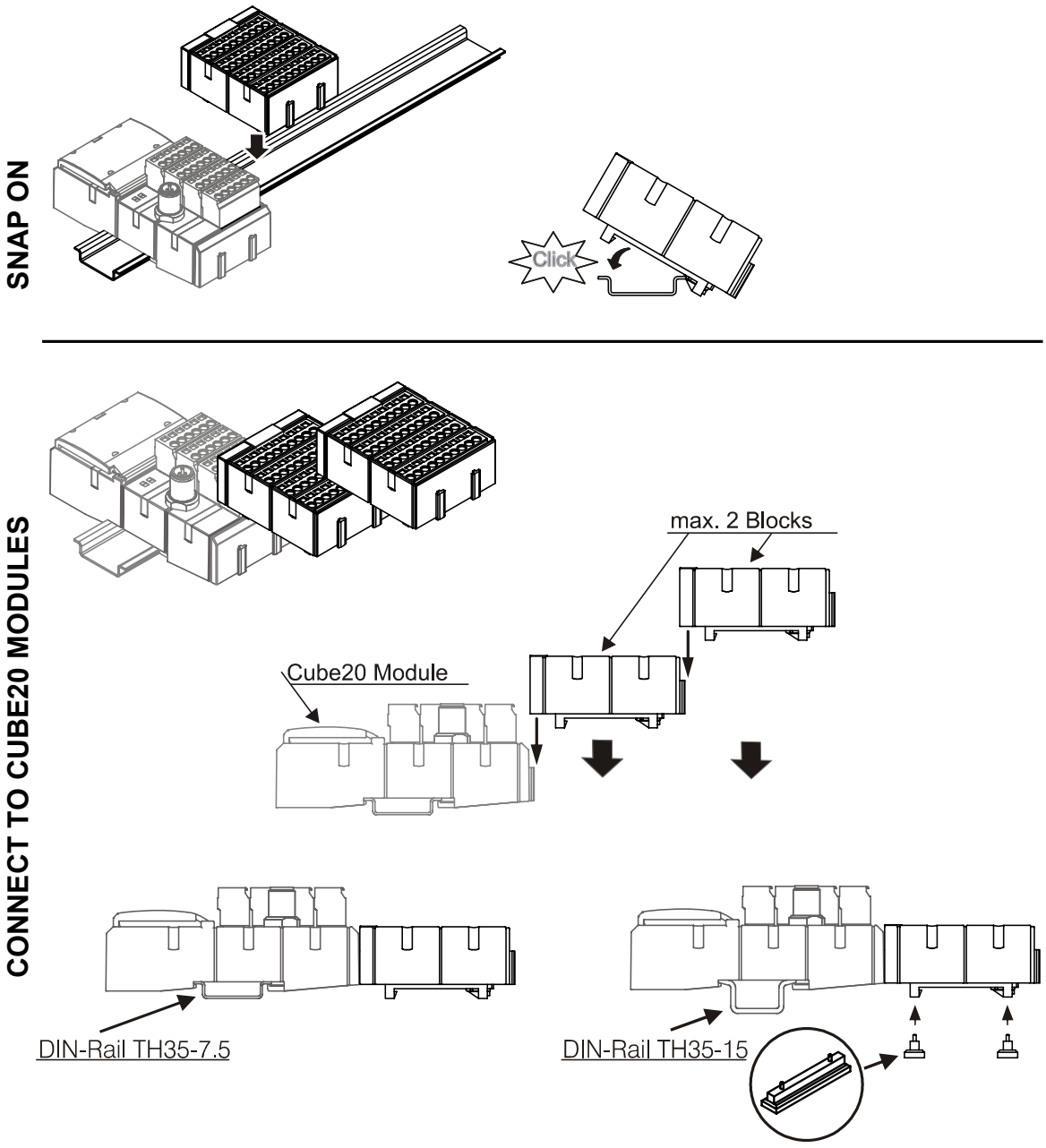


Fig. 6: Mounting the Potential Terminal Block on DIN rail and on the Cube20 Module

2.1.6 Labeling of Terminals

The figures X0 to X3 indicate the up to 4 terminal rows, the top row always beginning with X0.

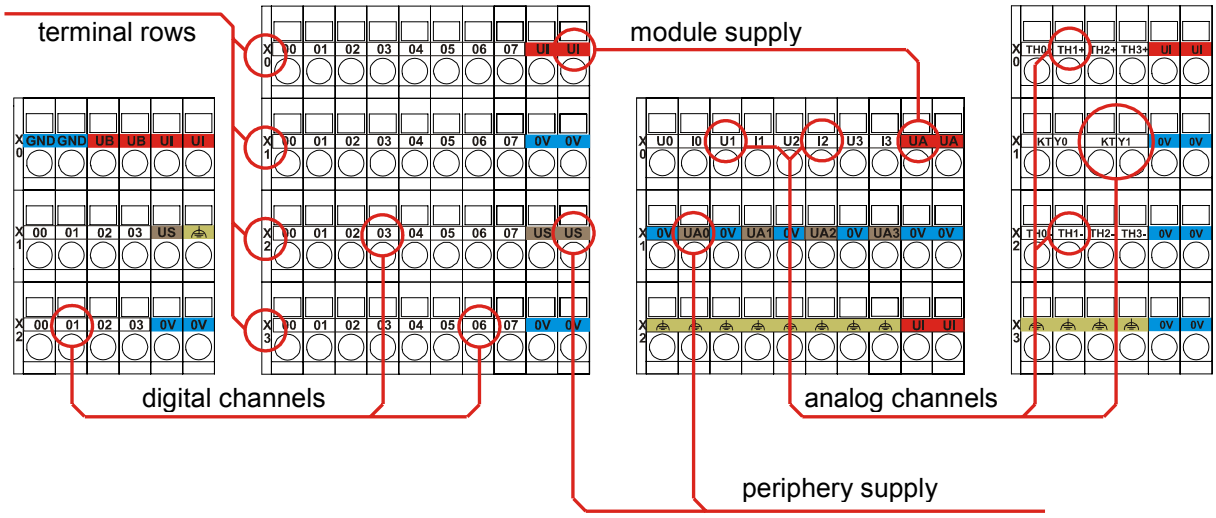


Fig. 7: Labeling of the terminals

Below a short explanation of the terms:

Module Supply

- **"UI"** Supply voltage of internal supply.
- **"UA" (red):** Actuator supply.
- **"GND":** Module - Ground

Periphery Supply

- **"US":** Sensor supply.
- **"UA0…UA3" (brown):** Actuator supply.
- **„0V“:** 0 Volt Potential
- : Function ground

Digital modules

- Inputs and outputs are labeled **„00…03“ or „00…07“**. Furthermore, the labeling corresponds to channel number and bit position.

Analog Modules

- Inputs and outputs are labeled **„S0…S3", „U0…U3 and I0…I3", „+R0…+R3", „TH0+…TH3+" or also „KTY0…KTY1“**. Furthermore, the labeling corresponds to channel number and bit position.

2.1.7 Terminal Wiring

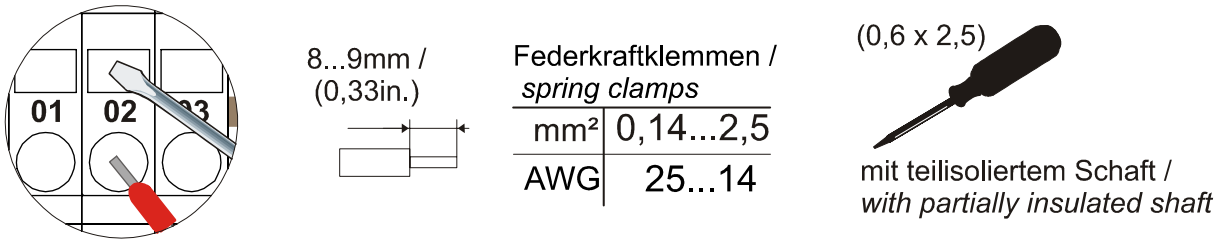


Fig. 8: Terminal Wiring

2.2 Connection Diagram

For the exact connection diagram and settings please refer to the corresponding product manuals.

You will find an overview in the section "Manual Overview and Layout" in this manual.

3. Configuration Notes

This chapter contains a short description of the Cube20 system components and information that is important during the electromechanical planning phase.

3.1 System Components

3.1.1 Product Designation Code

The designation format of Cube20 system components explains their function.

Examples:

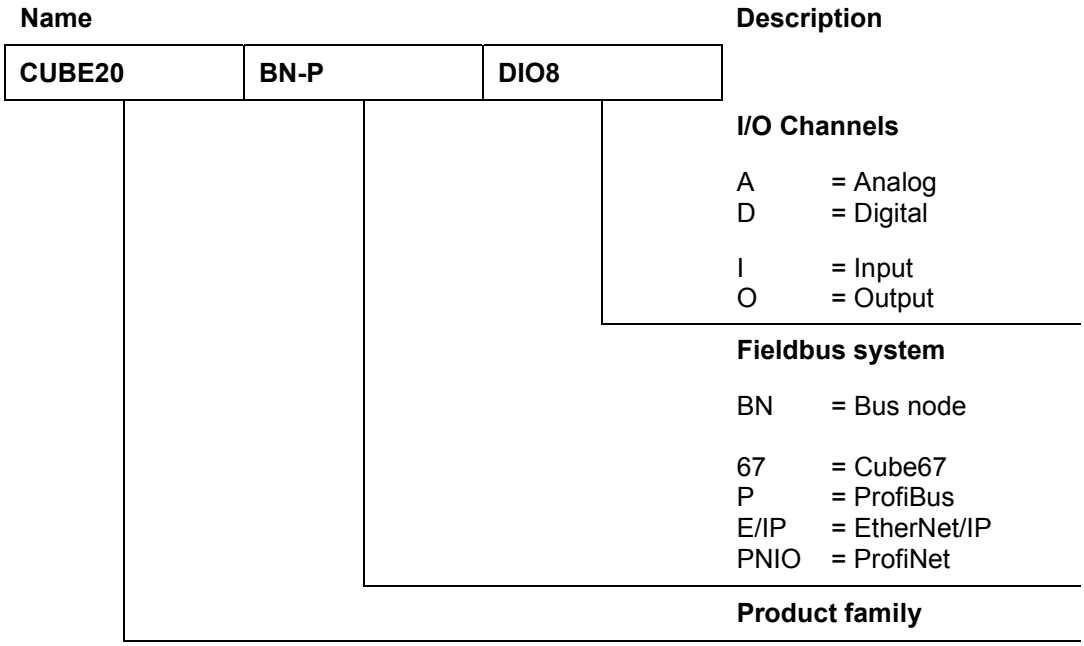


Fig. 9: Example Designation Code

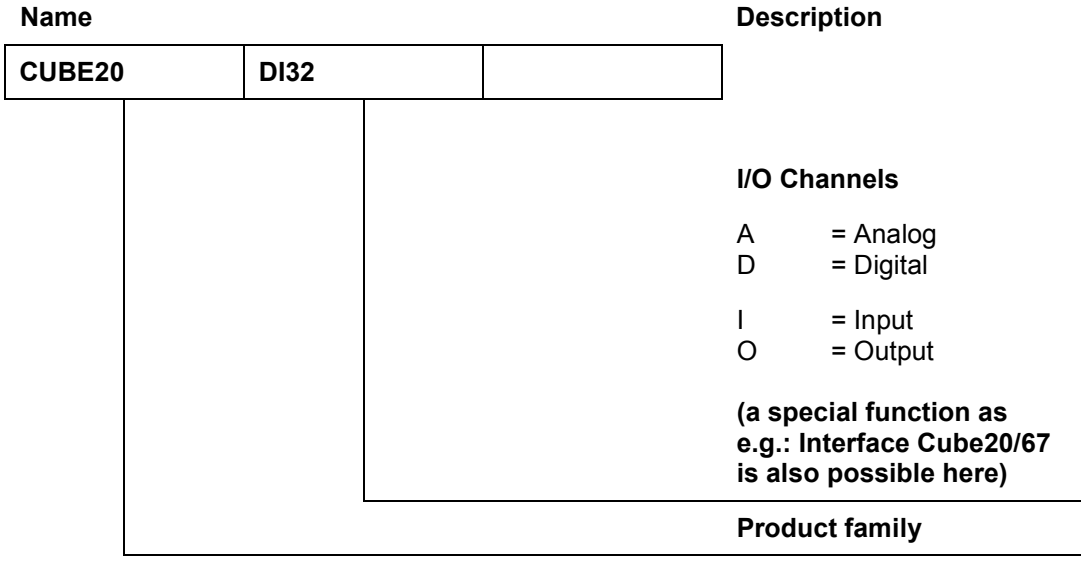


Fig. 10: Example Designation Code

3.1.2 Bus node

The purpose of the Cube20 System is the decentralized routing of signals at the I/O level and the supply of this information over a fieldbus network (e.g. Profibus). The central unit is the bus node that connects the Cube20 I/O modules to the fieldbus.

The bus node is supplied via the "UB" terminal; the BN67 is directly supplied via the internal system connection of Cube67.

The bus node has a connection for the internal system connection that connects a maximum of 15 I/O modules or 3 I/O modules ("BN67"). The parts are linked together by plugging in the ribbon cable.

Article number	Description
56001	Cube20 BN-P DI8
56005	Cube20 BN-E/IP DI8
56006	Cube20 BN-PNIO DI8
56450	Cube20 BN67 DIO8

Tab. 1: Bus node

For the exact connection diagram and settings please refer to the corresponding product manuals.

Exception:

"Cube20 BN67 DIO8 Art. No. 56450" which can be found as Cube67 connection in the Cube67 manuals.

„Cube20/67-Interface Art. No. 56140“ which can be found as Cube20/67-Interface in the Cube20 product manual.

You will find an overview in the section "Manual Overview and Layout" in this manual.

3.1.3 I/O modules

These modules are connected to the bus node via the internal system connection.

Extension modules

Extension modules are fitted out with an extension interface for the internal system connection, i.e. the latter can be routed to the following I/O modules. Up to four I/O modules can be connected to one segment. Attention! Only 3 I/O modules can be connected to the Cube20 BN67 DIO8, Art.No. 56450, (our Cube67 > Cube20 interface). An extension module can also be the sole or the last module of a segment.

Article number	Description
56112	Cube20 DI32
56117	Cube20 DO16 (2A)
56118	Cube20 DO32
56121	Cube20 DI32 NPN / PNP
56168	Cube20 DI16DO16
56200	Cube20 AI4 U/I
56201	Cube20 AI4 U/I
56220	Cube20 AO4 U/I
56221	Cube20 AO4 U/I
56230	Cube20 AI4 RTD
56240	Cube20 AI4 TH

Tab. 2: Extension modules

3.1.4 Cube20/67 Interface, Art. No. 56140

The Cube20/67 interface module is a module that links the Cube20 System to the Cube67 System. The Cube20/67 interface module is not an active module. It is not parameterized and supplies no diagnostics. The module is fieldbus-independent but must always be linked to the bus node (BN) via the internal system connection. The power LED indicates the status of the internal Cube20 system link. The US and UA LEDs indicate the Cube67 status. Galvanically, UA and UI are at the same potential (0V). To avoid EMC-related impacts, the bus mode GND must be linked to the bus node 0V of the Cube20/67 interface module.

Article Number	Description
56140	Cube20/Cube67 Interface

3.1.4.1 Topology

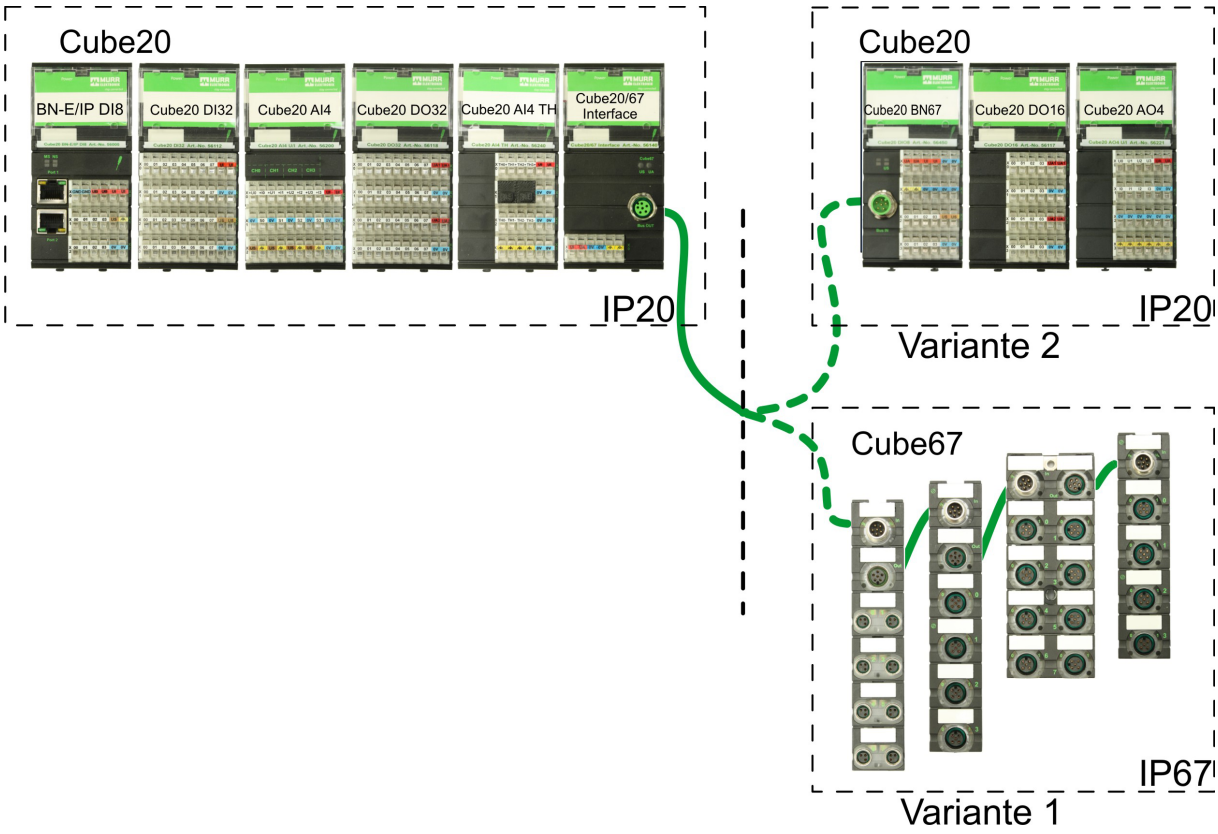


Fig. 11: Example of a Cube20/67 interface module with 2 system topology variants

Example

VARIANT 1: Cube20 + Cube67

1 Cube20 bus node
+
4 Cube20 modules
+
1 Cube20/67 interface module
+
4 Cube67 modules
=
10 modules

VARIANT 2: Cube20 + Cube20

1 Cube20 bus node
+
4 Cube20 modules
+
1 Cube20/67 interface module
+
1 Cube20 BN67 DIO8 M12
+
2 Cube20 modules
=
9 modules

Max. length of Cube67 system cables **10 m**

Note on system topology with a Cube20/67 interface module:

- A modular Cube20/67 fieldbus station can comprise up to 16 modules (Cube20 bus node + 15 Cube20/67 modules).
- The Cube20/67 interface module is counted as a module and can be included in the configuration (but need not).
- The Cube20/67 interface module can only be operated on Cube20 bus nodes and may only be used once in the station setup.
- Only max. 3 Cube20 modules can be connected to the Cube20 BN67 DIO8 M12 Art. No. 56450.

It is permitted to utilize the Cube20 BN67 DIO8 M12 Art. No. 56450 to connect to the Cube20/67 interface module Art. No. 56140.

3.1.5 Accessories

3.1.5.1 Potential terminal block

Article number	Description
56078	Potential terminal block gray / gray / brown / blue
56079	Potential terminal block gray / gray / yellow / blue
56080	Potential terminal block yellow / blue / yellow / blue
56081	Potential terminal block brown / blue / brown / blue
56082	Potential terminal block green / black / black / black / black
56109	Potential terminal block brown / brown / blue / blue
56110	Potential terminal block blue / blue / yellow / yellow
56111	Potential terminal block blue / yellow / brown / blue

Tab. 3: Potential terminal block accessories

3.1.5.2 Label sheet

Article number	Description
56113	Label sheet

Tab. 4: Label sheet accessories

3.1.5.3 Coding pieces for terminals

Article number	Description
56115	Coding pieces for terminals

Tab. 5: Accessories for terminal coding pieces

3.1.5.4 Profibus connector

Article number	Description
55585	Profibus plug with insulation displacement for rigid cables
55586	Profibus plug with insulation displacement for rigid cables and with programming connection
55587	Profibus plug with insulation displacement for flexible cables
55588	Profibus plug with insulation displacement for flexible cables and with programming connection

Tab. 6: AccessoriesProfibus plug

3.1.5.5 BUS cable

Article number	Description
7000-00000-8409999	Bus cable for Profibus, 100 m bundle
7000-00000-7989999	Bus cable for ProfiNet CAT5, 100 m bundle
7000-00000-7989999	Bus cable for ProfiNet CAT5, 100 m bundle

Tab. 7: BUS cable

Most cables and connectors are available in angled style.

3.1.5.6 Cable for Cube67 connection

Cube67 system connection		
Article number	**Description**	
	Male - straight / Female - straight green	Cable length
7000-46041-8020015		0.15 m
7000-46041-8020030		0.3 m
7000-46041-8020060		0.6 m
7000-46041-8020100		1 m
7000-46041-8020150		1.5 m
7000-46041-8020200		2 m

Tab. 8: Cube67 system connection

3.1.5.7 Cable for Cube67 connection

Cube67 system connection		
Article number	**Description**	
	Male - straight with open ended wires gray	Cable length
7000-15001-4140150		1.5 m
7000-15001-4140300		3 m
7000-15001-4140500		5 m
7000-15001-4140750		7.5 m
7000-15001-4141000		10 m

Tab. 9: Cube67 system connection

We offer a wide product range of actuators / sensors. Connectors, cables, and adapters up to customized parts.

3.1.5.8 MICO

Article number	Description	Nominal operating branch-circuit current (full load)
9000-41034-0100400	MICO 4.4 (4 channels)	4 A each
9000-41034-0100600	MICO 4.6 (4 channels)	6 A each
9000-41034-0401000	MICO 4.10 (4 channels)	10 A each
9000-41042-0100400	MICO 2.4 (2 channels)	4 A each
9000-41042-0100600	MICO 2.6 (2 channels)	6 A each
9000-41042-0401000	MICO 2.10 (2 channels)	10 A each

Tab. 10: Overview MICO variants

Information on products and accessories is available in our catalog and our online shop at: onlineshop.murrelektronik.com

3.2 Internal system connection

ATTENTION:

Inverting Cube20 I/O modules in a system can result in injury or serious damage to man and/or material.

Therefore it is important, that Cube67 system cables and Cube67 I/O modules are clearly labeled.

3.2.1 Topology

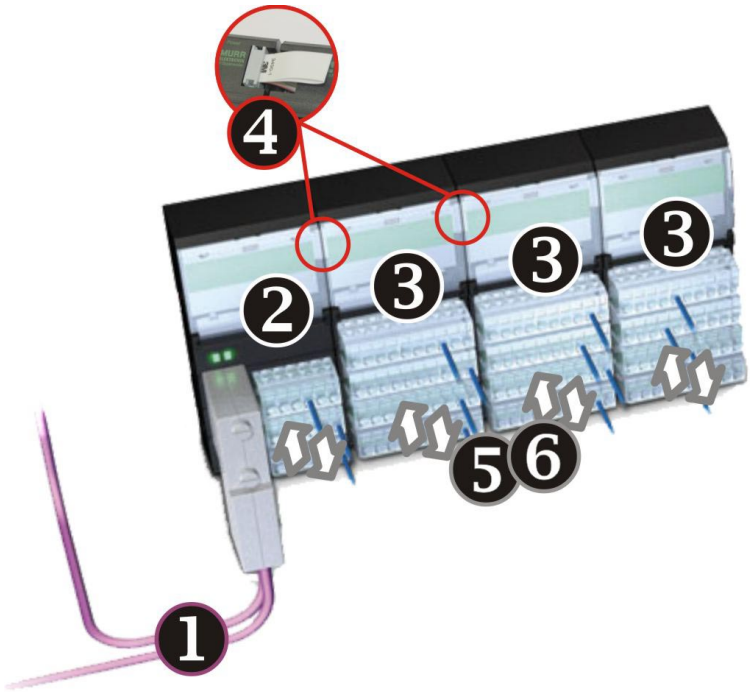


Fig. 12: Topology

❶ **Fieldbus cable**

❷ **Bus node**

❸ **Expansion module**

❹ **Internal system connection (integrated)**

❺ **Supply: module, sensor, actuator**

❻ **I/O**

The bus node has a connection for up to 15 I/O modules. It is not necessary to set the addresses of the modules. The modules are automatically addressed, according to their position.

3.2.2 Internal System Connection Terminations

No terminations required.

3.2.3 Maximum Expansion

3.2.3.1 Cube20 BN

Up to 15 expansion modules can be connected to a Cube20 bus node. The parts are linked together by plugging in the ribbon cable.

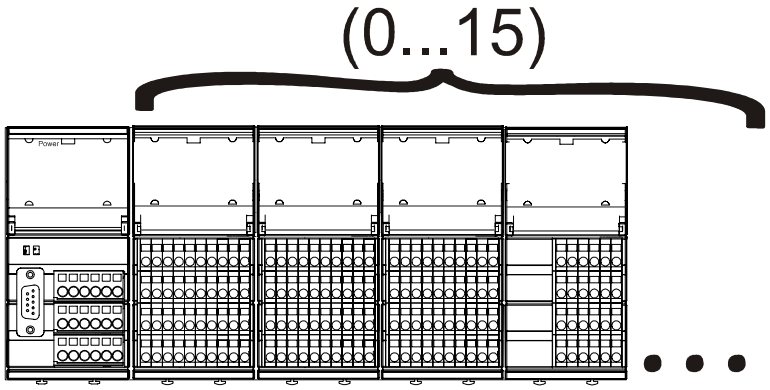


Fig. 13: Cube20 BN expansion

3.2.3.2 Cube20 BN67 DIO8 (Art. No. 56450)

Up to 3 expansion modules can be connected to a Cube67 to Cube20 system expansion. The parts are linked together by plugging in the ribbon cable.

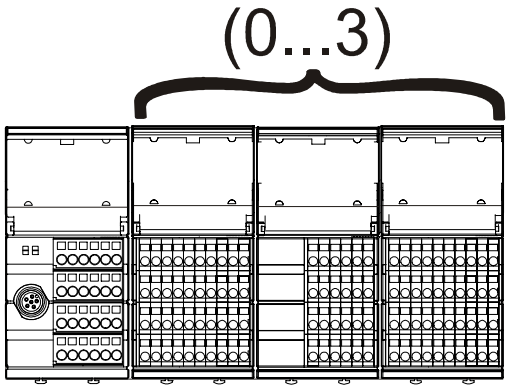


Fig. 14: Cube67 to Cube20 system expansion

In addition the requirements for the maximum expansion of the Cube67 system (system connection) have to be observed. They are described in the Cube67 or Cube67+ System Manual (art. no. 56970).

3.2.3.3 Cube20/67 Interface Module (Art. No. 56140)

Up to 15 modules can be connected to a Cube20 system expansion. The CUBE67 system cable is used as the electrical connection. Sensor and actuator power supply for the Cube67 modules is provided via the Cube20/67 interface.

Refer to the requirements for maximum expansion of the Cube67 System (system link). You will find this in Cube67 or Cube67+ System Manual (Art. No. 56970).

Note the sequence:
It is not permitted to connect the Cube20/67 interface module Art. No. 56140 downstream of a Cube20 BN67 DIO8 Module Art. No. 56450.

The max. length of the Cube67 system cable is 10 m.

3.2.4 Load rating

It is not necessary to pay attention to the load of the internal system connection, because the I/O supply is connected directly to the corresponding I/O module.

3.3 Power Supply

3.3.1 Configuration Notes

Bus modules require a direct-voltage power supply of typically 24 VDC (SELV/PELV) which must comply with the regulations of conventional industrial power-utility companies.

In order to optimize interference immunity, we advise you to power sensors, bus, and actuators from different sources. The power supply should be primary switched-mode or regulated power supplies.

The output of the power supply units depends on the number of connected load and their output.

In any case, it must be ensured that the system voltage does not drop below 18 V DC viewed from the system power supplies and measured at the remotest slave. System response becomes unspecific if sensor and bus power supply drop below 18 V DC.

Primary switched-mode power supply units normally permit an increase in output voltage to the amount of the rated voltage in order to compensate for any power losses.

Modules with digital inputs support the direct connection of commercially available sensors. A separate power supply may be necessary for the sensors if the total power required is high due to the number of slaves or a high power draw of the sensors.

3.3.2 Galvanic separation

Galvanic separation between the supply of the system supply and the sensor supply has to be provided. In order to maximize the electromagnetic compatibility we recommend to ensure galvanic separation.

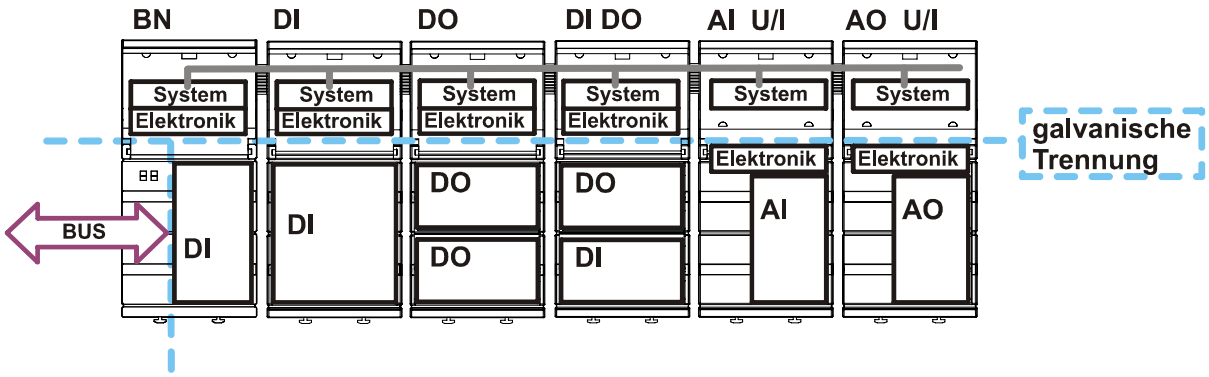


Fig. 15: Typical system structure with galvanic separation

The illustration above shows a typical Cube20 system structure with digital inputs and outputs (DI/DO) and analog inputs and outputs (AI/AO).

Furthermore it shows that Profibus, I/O area and I/O supply as well as the supply of the system electronics are galvanically separated. The internal electronics of the digital input/output modules are supplied by the system cable. The internal electronics of the analog input/output modules are supplied via the input/output supply voltage.

3.3.2.1 Information on the analog I/O modules.

The I/O supply voltage must always be connected, otherwise communication via the internal system connection is interrupted starting from the analog module that is not supplied.

3.3.2.2 Information on the Cube20/67 interface module (Art. Nr. 56140)

Galvanically, the supply voltages UA and UI are at the same potential (0V).

Galvanically, connected Cube67 modules are not separated from the module electronics of the Cube20 System.

3.3.3 Recommended power supply units

Primary switched-mode power supply units from Murrelektronik are specially designed to power automation systems. For this reason, we recommend them to power the modules.

Note for DeviceNet users:

We recommend so-called Class 2 power supplies for the supply of the DeviceNet bus.

Please contact our sales support regarding information about "ODVA" certified power supplies.

Phases	Output rating	Input voltage 95...132 V AC	Input voltage 185...265 V AC
1	240 W / 10 A	85086	85085
1	480 W / 20 A	85088	85087

Tab. 11: Recommended power supply units MCS Power+ single phase

Phases	Output rating	Input voltage 3 x 340...460 V AC
3	240 W / 10 A	85095
3	480 W / 20 A	85097
3	960 W / 40 A	85099

Tab. 12: Recommended power supply units MCS Power+ three phase

Murrelektronik offers an extensive range of primary switched power supply units.

Please refer to our catalogs or: www.murrelektronik.com

3.3.4 Cable Cross Sections

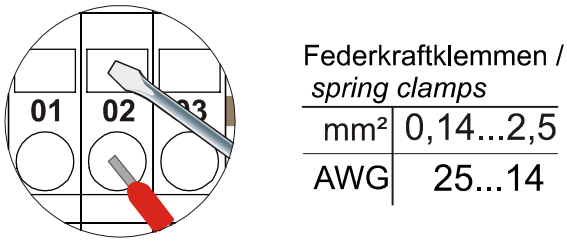


Fig. 16: Cable cross sections

3.3.5 Electromagnetic Compatibility (EMC)

This device meets the requirements of EC Directive 89/336/EEC "Electromagnetic Compatibility".

This device is Class A equipment and may cause radio-frequency interference in residential areas. In this case, the operator may be required to implement adequate countermeasures.

The devices described in this manual each meet the relevant standards for electromagnetic compatibility. However, this does not mean that their electromagnetic compatibility is still guaranteed when installed in a plant or machine.

For this reason, we urgently advise you to comply with the instructions on installation in accordance with EMC requirements below. Only then can you assume that the overall system complies with EMC requirements, provided CE-marked components are used exclusively.

Protection against Electrostatic Discharge

The products described in this manual contain complex semiconductor components which may be destroyed or damaged by electrostatic discharge (ESD).

Damage does not necessarily lead to immediate, detectable failure, or malfunction. These states may be even delayed, or occur sporadically.

The generally accepted safety precautions for ESD sensitive devices must be observed when handling the devices. The following precautions must be taken:

Never plug or unplug connectors while the equipment is under power.

If you are an operator, discharge any static charge you may be carrying just before you touch the equipment. For example, you can touch a grounded part of the machine, or wear an ESD discharge strap that is permanently connected to ground.

Grounding

A short (as short as possible), low-impedance connection between the grounding point and the reference ground is essential to divert interference voltages running between the device and reference ground.

The inductivity of standard FE conductors is a high impedance for high-frequency interference voltages. For this reason, the use of grounding straps is advisable. If this is not possible, a fine-wire FE conductor should be selected with the largest possible cross section, and the connection to ground should be kept as short as possible.

Cable Routing

You can avoid EMC problems by observing elementary basic rules of cable routing:

- Route data lines as far as possible away from power lines.
- Route data lines and power lines at least 10 cm apart.
- Intersect data and power lines at right angles only.
- Route data and power lines in separate, shielded compartments.
- Remember the interference potential of other devices or lines when routing the cables.
- Place frequency converters, motor lines, and other devices and lines that emit high-frequency interference at the greatest possible distance.

Voltage Drops

Short-term voltage drops (<10 ms) normally pose no operational problems as the electronics are protected by capacitors integrated in the power circuits. This does not apply to the power supply of the sensors and actuators connected to the module. Their high power requirement cannot be covered by the capacitors integrated in the device. For this reason, even transient interruptions of the actuator supply can result in undesirable switching operations.

Due to the integrated input filter, a change in the input signal of less than 1 ms does not cause a change of the input state signaled to the Master. Longer interruptions of the sensor supply may cause changes of the input signal.

Separate Power Supplies

Sensors or actuators can be powered by a common power supply unit. However, it is preferable to use separate power supplies in order to maximize the electromagnetic compatibility of the overall system.

Interference Suppression of Inductive Loads

The outputs of the devices described in this manual have an integrated protective circuit that provides safety against high-energy interference voltages, such as those that occur when inductive consumers are switched.

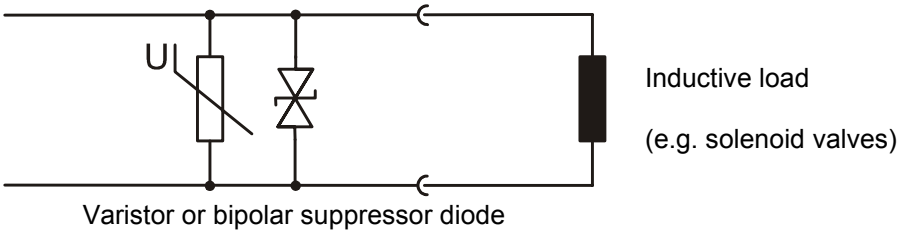


Fig. 17: Interference Suppression of Inductive Loads

A suppressor diode helps to quickly reduce the energy stored in the inductive load of a magnetic field. However, it is recommended to use commercially available protection circuits for inductive loads, especially loads in the range of the maximum current-carrying capacity of a channel at switching frequencies of > 1 Hz. These protection circuits can reduce the energy stored in the connected inductances.

The high voltages that occur when inductive loads are shut down result in strong fields in the cables with consequential faults in adjacent circuits or devices.

Murrelektronik offers a wide selection of interference suppression products for this purpose.

Please refer to our catalogs or:

onlineshop.murrelektronik.com

Other Measures and Limits

In some system configurations, the requirements for interference emission and immunity from interference can only be met with additional measures, or even not at all. In these cases, the EMC within the system is also dependent on the single components of other manufacturers.

Mains filters are a suitable means of reducing line-conducted interference. Various manufacturers offer optical-fiber converters. This data transmission technology is basically immune to EMC interferences. However, this does not apply to the electronic conversion circuits. For this reason, the use of optical fibers does not solve all EMC problems.

Our certified test center will answer your questions regarding EMC. They will give advice on guaranteeing compliance with the EMC directive for the system you produce.

Murrelektronik Test Center,

Grabenstraße 27,

D-71570 Oppenweiler

Phone ++7191 47-334,

Fax ++7191 47-323,

Pruefzentrum@murrelektronik.de

3.4 Connecting Sensors and Actuators

Attention:

Cube20 modules are no safety-related devices according to the relevant standards. The Off-status of the outputs must not be used to meet safety-related requirements of the application!

3.4.1 Sensor Supply

Sensors can be supplied by the I/O module. The sensor supply of each module is secured by an electronic, self-resetting fuse. The max. current draw for the sensor supply is 0.7 A for each module.

There is no derating for the sensor supply.

WARNING!

The capacity per digital input is 10 nF.

3.4.2 Supply of external components

The actuator supply (not switchable) for the analog output modules is provided. For each UA0...UA3 terminal (brown), 1.6 A current are available.

3.4.3 Actuators

Please see the corresponding Instruction manual for the maximum current that can be taken from the outputs.

Information about derating:

- AO modules do not have derating.
- For DO modules, the following derating curves are applicable, if **all outputs** are switched at the same time.

Derating DO for 0.5 A

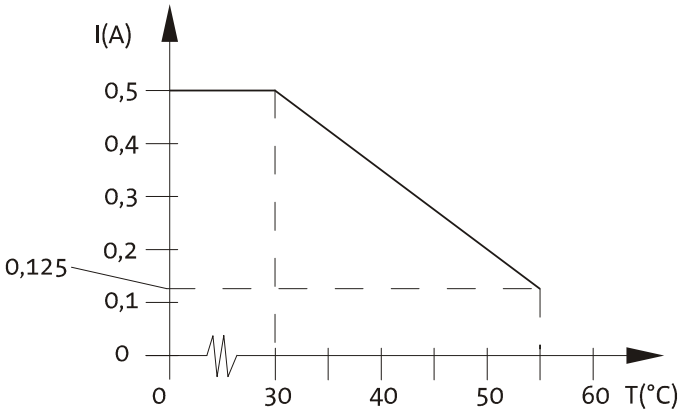


Fig. 18: Derating curve of the DO modules for 0,5A

Derating DO for 2 A

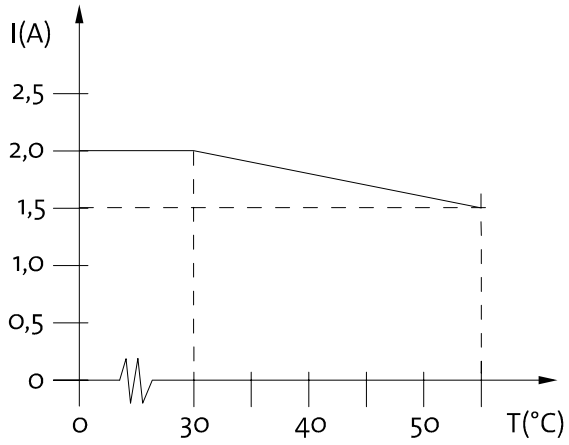


Fig. 19: Derating curve of the DO modules for 2A

ATTENTION:

The module may be damaged if the actuator power supply polarity is reversed.

To increase power, outputs may be connected in parallel.

If an overload or short-circuit occurs at an output, that output is shut down. This output will remain disabled even when the error has been corrected. In order to reset the short-circuit memory, the output must be reset or the actuator supply switched off.

3.5 Information about the data of the I/O modules

By means of the device identification the fieldbus master gets information about the data capacity, operation mode, etc. for peripheral modules (I/O modules). After having detected the slaves the master generates from this data a map of all detected I/O modules of the bus system. The data of the I/O modules are mapped in a list according to the logical arrangement in the fieldbus.

The user can now map the entries of the bus master list to addresses in the PLC. This will create the process image of the inputs and outputs (PII/PIO).

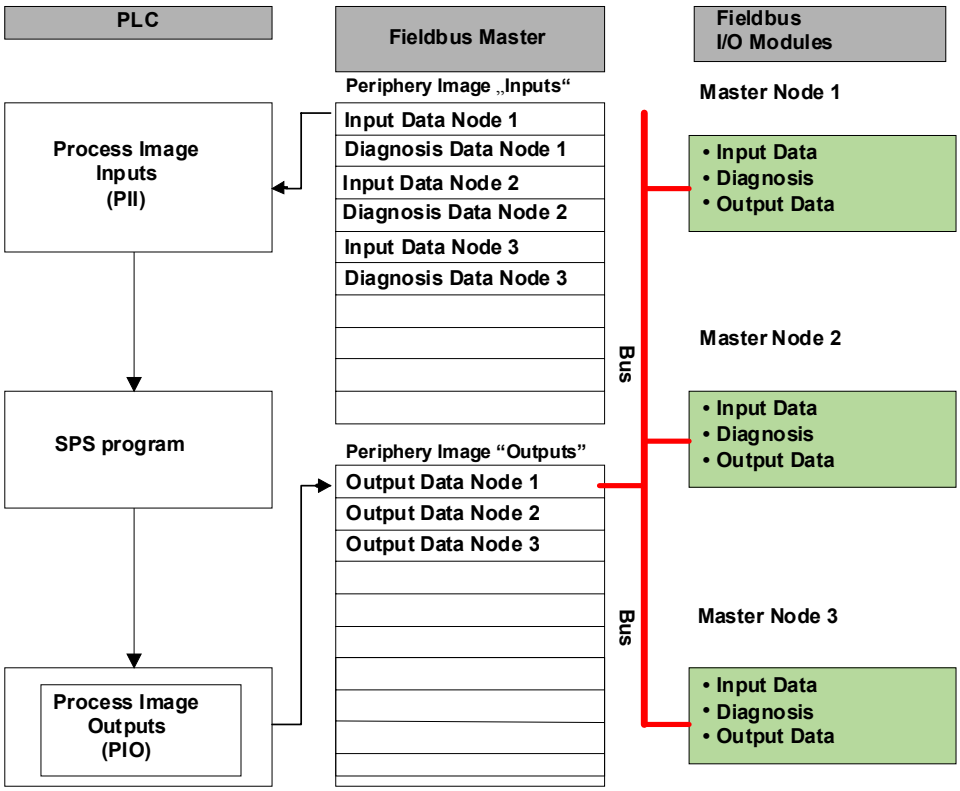


Fig. 20: Data transfer between PLC, fieldbus master and bus devices

Data transfer between PLC, fieldbus master and bus devices

For the module specific I/O data, please refer to the corresponding product manuals.

You will find an overview in the section "Manual Overview and Layout" in this manual.

4. Diagnostics

4.1 LED - Indicators

4.1.1 Significance of the states of the "Power" LED

4.1.1.1 On the bus node

The "Power" LED indicates the status of the Cube20 system voltage and the internal communication.

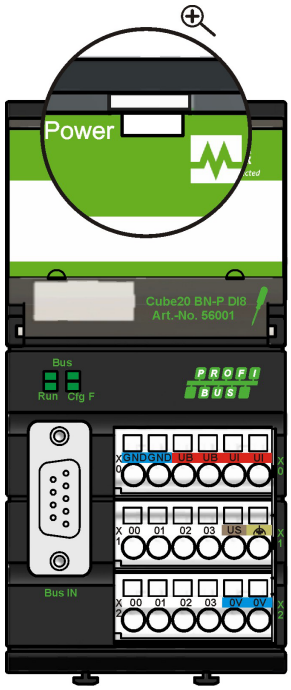
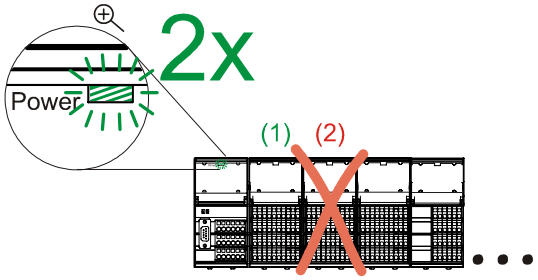


Fig. 21: Example Power LED on Cube20 Modules

Behavior of the Power Led of Cube20 BN Modules

Color		Significance for Power LED	Remedy
	green	System voltage (>12V) available	
	Green flashing	System connection in the Cube20 system is interrupted, no. of flashing pulses corresponds to the position of the faulty expansion module (1…15), with several modules the closest one	Replacement of the affected module and power reset at terminal UB of the Cube20 BN module
		Example: 	
	off	No system power (<12V)	Increase voltage

Tab. 13: Behavior of the Power Led of Cube20 BN Modules

4.1.1.2 Power LED on the I/O modules

The "Power" LED indicates the status of the Cube20 system voltage and the internal communication.

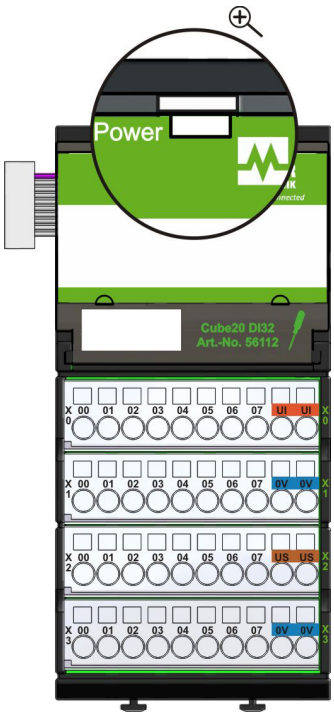


Fig. 22: Example Power LED on Cube20 Modules

Behavior of the Power LED of Cube20 I/O modules

Color		Significance for Power LED	Remedy
	fast flashing (approx. 20Hz)	System power available and module exchanging data	
	off	No system power via the Cube20 system connection	• Wait for initialization of the Cube20 system (can take some seconds) • Check the internal system connection (ribbon cable) and power reset at terminal UB of the Cube20 BN module

Tab. 14: Behavior of the Power LED of Cube20 I/O modules

Verhalten der Power-LED an Cube20/67-Interface-Modulen

Farbe		Bedeutung für Power LED	Abhilfe
	grün	UI und Weiterschaltung vorhanden	Funktion i.O.
	aus	UI fehlt oder Initialisierung läuft	• UI muss vor dem Starten des Cube20 Systems anliegen. • Initialisierung des Busknotens kann einige Sekunden in Anspruch nehmen

Tab. 15: Verhalten der Power-LED an Cube20/67-Interface-Modulen

4.1.2 (In the corresponding product manual!) Meaning of the "Bus Run" LED and the "Cfg F" LED states

They are described in the Cube20 product manuals. For an overview please refer to the beginning of this manual, chapter "About the User Manual and its Structure".

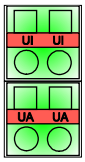
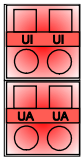
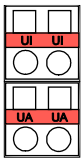
4.1.3 Displays for Supply Voltage at the Terminals of All Modules

4.1.3.1 Module Supply

There is no LED at terminal "UB". The state of system voltage is signalized by the Power LED.

See chapter: Significance of the states of the "Power" LED

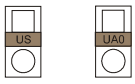
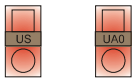
- Indicators with **„UI“** show the state of the supply voltage for the internal supply.
- Indicators with **„UA“** show the state of the supply voltage for actuators.

LED indicator UI and UA	Response	State
	green	Supply voltage OK (>= 18V)
	Red	Under voltage (< 18V)
	off	Voltage <= 12.5V

Tab. 16: LED Module Supply

4.1.3.2 Periphery Supply

- Indicators with **„US“** show the state of the supply voltage for sensors.
- Indicators with **„UA0…UA3“** show the state of the supply voltage for actuators.

LED Display US and UA	Response	State
	off	Supply voltage OK
	Red	Overload or short circuit of the sensor or actuator supply

Tab. 17: LED Periphery Supply

Two terminals each have one common "US" LED.

4.1.4 Signal Logic State and LED Behavior

4.1.4.1 Digital modules

A separate status indicator is assigned for each input and output. It is labeled with **"00…03" or "00…07"**. Furthermore, the labeling corresponds to channel number and bit position. It is situated under the corresponding terminal and allows easy mapping to the state of the peripheral components, sensors and actuators.

Connection of signal logic state and LED behavior at the input

LED Display		Logical value	Voltage at input	Signal
	off	0	0 V	NO input
	Yellow	1	24 V	

Tab. 18: LED at Input of Digital Modules

Connection of signal logic state and LED behavior at the output

LED Display		Logical value	Voltage at output	Signal
	off	0	0 V	Output
	Yellow	1	24 V	
	Red	1	0 V	Output in case of short-circuit

Tab. 19: LED at Output of Digital Modules

When inductive loads are switched off, the diagnostic LED on the output channel of modules 56118 and 56168 may light up briefly. This does not represent a module malfunction. The module does not sustain any damage.

4.1.4.2 Analog Modules

A separate status indicator is assigned for each input and output. The corresponding LED is situated under the respective terminal.

Cube20 AI4 U/I Art.-No.: 56200 / 56201

The terminals are labeled with the channel numbers **"S0…S3"**.

LED Display		State	Possible diagnostics
	off	OK	-
	Red	Diagnostics	• Line break • Measuring range overshot • Measuring range undershot

Tab. 20: LEDs of the Channels of the Analog Modules Cube20 AI4 U/I Art. No.: 56200 / 56201

Cube20 AO4 U/I Art.-No.: 56220 / 56221

The terminals are labeled with the channel numbers **"U0…U3" and "I0…I3"**.

LED Display		State	Possible diagnostics
 	off	OK	-
 	Red	Diagnostics	• Line break • Actuator short circuit

Tab. 21: LEDs of the Channels of the Analog Modules Cube20 AI4 U/I Art. No.: 56200 / 56201

Cube20 AI4 RTD Art.-No.: 56230

The terminals are labeled with the channel numbers **"+R0…+R3"**.

LED Display		State	Possible diagnostics
	off	OK	-
	Red	Diagnostics	• Line break • Measuring range overshot • Measuring range undershot

Tab. 22: LED of the channels of the analog module Cube20 AI4 RTD Art.-No.: 56230

Cube20 AI4 RTD Art.-No.: 56240

The terminals are labeled with the channel numbers **"TH0+…TH3+"**.

LED Display		State	Possible diagnostics
	off	OK	-
	Red	Diagnostics	• Line break • Measuring range overshot • Measuring range undershot • Wire break cold junction compensation (KTY)

Tab. 23: LEDs of the channels of the analog module Cube20 AI4 TH Art.-No.: 56240

4.1.4.3 Cube20/67 Interface Module, Art. No. 56140

Significance of the US / UA Cube67 LED on the M12 socket:

LED Display	Response	State
	green	Voltage connected through for Cube67 modules (up to US > 6V).
	red	Short-circuit or overload on Cube67 System. Same as Cube67 system link.
	off	US / UA not available. Modules not yet initialized.

Tab. 24: US / UA Cube67 LED at M12 socket

4.2 (In the corresponding product manual!) Diagnostics via the Fieldbus

These diagnostics depend on the fieldbus. Please refer to the corresponding instruction manual of the bus node (BN) used.

For an overview please refer to the beginning of this manual, chapter "About the User Manual and its Structure".

Glossary

Actuator shutdown	"Short circuit or overload at an output causes the output to switch off."
AI	Analog Input
AO	Analog Output
BN-P	Bus Node - Profibus, bus node - Profibus
Bus-Run-LED	LED that signals the bus status
Bus segment	"Due to the electrical specification of the RS-485 interface, the number of users on an RS485 network is limited to 32 users. If there are more than 32 Profibus users, the network must be divided into segments by means of repeaters."
Byte	Term from IEC 61158. Corresponds to 1 Byte or 8 bits.
Cfg F-LED	LED to signal a correct/incorrect configuration
DI	Digital input
DIN TH35	DIN standard mounting rail (35x15mm, 35x7.5mm)
DO	Digital Output
DP"	Decentralized periphery. Profibus protocol for rapid cyclical data exchange."
E/A(I/O)	Input/output -
EC Directive 2004/108/EEC	EMC directive
EMC	Electromagnetic Compatibility
ESD	Electrostatic discharge
FE	Function ground
Freeze Command	The input data of the slave are "frozen".
GSD	The Device Master Data describes the technical features of a Profibus product. This file is required to configure a Profibus system and is provided by the device manufacturer."

I	Current
I/O-	Input/ Output
ID number	"A 16-bit number that identifies a Profibus product uniquely. It represents a reference for the GSD file. Several devices have the same ID number, provided they are described in a common GSD file. This number is awarded by the Profibus user Organization.
IEC 61158	Worldwide standard for Profibus DP and FMS. Successor of international standard EN 50170, Volume 2."
IP20	Ingress Protection, 20 = Device protection against the ingress of solid foreign bodies measuring a diameter of more than 12.5 mm (finger protection), the device is not protected against ingress of water with deleterious impacts.
LSB	Least significant bit
LWL	Optical fiber
MSB	Most significant bit.
Ni	Nickel
PAA	Process map of outputs
PAE	Process map of inputs
PELV	Protective Extra Low Voltage
PNO	Profibus User Organization.
Power-LED	LED to signal the operating status
Pt 100	Electrical resistance 100W of a platinum wire at 0°C
+R	High potential sensor connection.
-R	Low potential sensor connection.
Repeater	Coupling element to process signals between Profibus segments.
RL	Sensor power supply in three-wire mode.
RTD	Resistance Temperature Device.
S	Reference potential
	SELVSafety Extra Low Voltage.
Simatic Manager	Programming software for program-logic controllers made by Siemens
PLC	Program-logic controller

TH	Thermocoupler
TH-	Low potential sensor connection.
TH+	High potential sensor connection
Type E, Type J, Type K,	
Type N, Type R	Thermoelements as per DIN EN 60584 standard.
U	Voltage
U/I	Voltage / current
UA (brown terminal)	Actuator power supply
UA (red terminal)	Module power supply
UB	Operating voltage.
UI (red terminal)	Module and sensor supply
US BROWN	sensor supply
VDMA	Verband Deutscher Maschinen- und Anlagenbau e.V. (Association of German Machinery and Industrial Equipment Manufacturers)
VZ	Sign.
ZVEI	Zentralverband Elektrotechnik- und Elektronikindustrie e.V. (German Electrical and Electronic Manufacturers' Association).

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